FORM PTO-1390 (REV 11-2000)	U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY 'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		136.161
		U.S APPLICATION NO. (If known, see 37 CFR 1 5) 09/890312

INTERNATIONAL APPLICATION NO. PCT/FR00/00152	INTERNATIONAL FILING DATE 25 January 2000 (25.01.00)	PRIORITY DATE CLAIMED 27 January 1999 (27.01.99)

TITLE OF INVENTION SIGNAL PROCESSING METHOD FOR A DIGITAL WIDE BAND RADIO RECEIVER AND CORRESPONDING RADIO RECEPTION ARCHITECTURE

APPLICANT(S) FOR DO/EO/US Jacques Palicot and Christian Roland

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.

4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).

5. [x] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [x] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).

6. [x] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [x] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).

7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.

8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).

9. [x] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (unsigned)

10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [x]* An Information Disclosure Statement under 37 CFR 1.97 and 1.98. International and French Search Reports and references.

12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. [x] A FIRST preliminary amendment.

14. [ ] A SECOND or SUBSEQUENT preliminary amendment.

15. [x] A substitute specification., claims and abstract.

16. [ ] A change of power of attorney and/or address letter.

17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.

18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).

19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

20. [x] Other items or information: French-language International Preliminary Examination Report

U.S. APPLICATION NO. (if known see 37 CFR 1.5) 09/890312	INTERNATIONAL APPLICATION NO PCT/FR00/00152	ATTORNEY'S DOCKET NUMBER 136.161

21. [x] The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.......... $1000.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $860.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

CALCULATIONS PTO USE ONLY

ENTER APPROPRIATE BASIC FEE AMOUNT = $860.00

Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)). $ --

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$
Total claims	26 - 20 =	6	x $18.00	$108.00
Independent claims	2 - 3 =	0	x $80.00	$ --
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $270.00	$ --

TOTAL OF ABOVE CALCULATIONS = $968.00

[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. + $ --

SUBTOTAL = $968.00

Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). $ --

TOTAL NATIONAL FEE = $968.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property + $ --

TOTAL FEES ENCLOSED = $968.00

Amount to be refunded:	$
charged:	$

a. [X] A check in the amount of $ 968.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

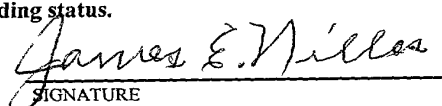c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-1080. A duplicate copy of this sheet is enclosed.

d. [ ] Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

National Phase of PCT/FR00/00152

International Filing Date: 25 January 2000

Inventors: Jacques Palicot and Christian Roland

Title: *Signal Processing Method for a Digital Wide Band Radio Receiver and Corresponding Radio Reception Architecture*

Priority: French Application No. 99 01068; Filed 27 January 1999

Attorney Docket: 136.161   Customer No. 023907

PRELIMINARY AMENDMENT

DO/EO/US
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This Preliminary Amendment is directed to a new U.S. application as identified above. Please enter this preliminary amendment prior to calculating the fees.

Please substitute the attached specification, claims, and abstract (16 pages) and use the substitute application for examination purposes.
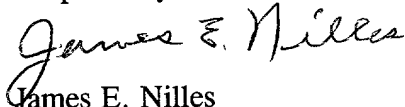
REMARKS

The substitute specification has been amended to insert headings, and an Abstract of the Disclosure has been added. The claims incorporate revisions made during international preliminary examination under Article 34, and are further amended to eliminate the multiple dependencies. A marked-up version of the changes made to the modified claims under Article 34 is attached and entitled *Version with Markings to Show Changes Made*.

Preliminary Amendment - Jacques Palicot et al.
Signal Processing Method for a Digital Wide Band...
Attorney Docket 136.161
Page 2

Entry of the amendments and early consideration and allowance are respectfully

requested.

Respectfully submitted,

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Date: July 26, 2001

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

CLAIMS

5   1. Method for processing the radio signals of a plurality of radiocommunication standards occupying a wide band of frequencies, characterised in that it comprises the following steps :
- a wide band analysis step [(101-106)] for acquiring
10   information concerning the radio signals contained in said wide band of frequencies and selecting a suitable narrow band processing for demodulating said radio signals, and
- a step for the narrow band processing [(107-110)] of said
15   radio signals contained in said wide band of frequencies so as to demodulate them.
       2. Method according to claim 1, characterised in that the wide band analysis step consists of looking for from the channels of the radiocommunication standards those channels
20   containing radio signals able to be demodulated in said narrow band processing step.
       3. Method according to claim 1, characterised in that the wide band analysis step [(101-106)] consists of acquiring information for identifying the radiocommunication
25   standard associated with each of said radio signals contained in said wide band of frequencies.
       4. Method according to claim 3, characterised in that the wide band analysis step consists of looking for the carrier frequency and/or the band width of the radio signals
30   contained in said wide band of frequencies.
       5. Method according to claim 3 [or 4], characterised in that the wide band analysis step further consists of looking

for the cycle frequency and/or type of modulation of the radio signals contained in said wide band of frequencies.

6. Method according to [one of claims 3 to 5] claim 3, characterised in that the wide band analysis step comprises a step for the digital/analog conversion [(103)] of the radio signals of said wide band of frequencies and a step for the digital processing [(104-106)] of the resultant digital signals so as to obtain said information concerning the radiocommunication standard of said radio signals.

7. Method according to [one of claims 1 to 6] claim 1, characterised in that, for each radio signal contained in said wide band of frequencies, the narrow band processing step comprises a step [(107; 108)] for extracting said radio signal and a step [(110)] for demodulating said extracted radio signal.

8. Method according to claim 7, characterised in that the step for extracting said radio signal is effected by an analog filtering [(108)] of the wide band of frequencies when the radiocommunication standard of said radio signal has a maximum peak power greater than a threshold value.

9. Method according to claim 7 [or 8], characterised in that the radio signal extraction step is effected by a digital filtering [(107)] of the analysed radio signals when the radiocommunication standard of said radio signal has a maximum peak power lower than a threshold value.

10. Method according to claim 8 [or 9], characterised in that said threshold value depends on the resolution of the digital signals at the end of the step for the analog/digital conversion [(103)] of said wide band analysis step.

11. Method according to [one of claims 1 to 10] claim 1, characterised in that the wide band of frequencies is

analysed per portion of several tens of megahertz.

12. Method according to [one of claims 1 to 10] <u>claim 1</u>, characterised in that the wide band of frequencies is analysed standard by standard.

13. Software radio receiving unit able to process the radio signals of a plurality of radiocommunication standards occupying a wide band of frequencies, characterised in that it comprises :

- wide band analysis means for acquiring information concerning the radio signals contained in said wide band of frequencies and selecting a narrow band processing of said radio signals according to the information acquired by said wide band analysis means, and

- narrow band processing means for demodulating said radio signals contained in said wide band of frequencies.

14. Receiving unit according to claim 13, characterised in that the wide band analysis means carry out a search from the channels of the radiocommunication standards those channels containing radio signals.

15. Receiving unit according to claim 13, characterised in that the wide band analysis means carrying out a search for information are able to identify the radiocommunication standard associated with each of said radio signals contained in said wide band of frequencies.

16. Receiving unit according to claim 15, characterised in that the wide band analysis means look for the carrier frequency and/or the band width of the radio signals contained in said wide band of frequencies.

17. Receiving unit according to claim 15 [or 16], characterised in that the wide band analysis means in addition look for the cycle frequency and/or the modulation type of the radio signals contained in said wide band of

frequencies.

18. Receiving unit according to [one of claims 13 to 17] claim 13, characterised in that the narrow band processing means comprise means for extracting the radio signals contained in said wide band of frequencies and means for demodulating said extracted signals.

19. Receiving unit according to [one of claims 13 to 18] claim 13, characterised in that the wide band analysis means comprise a first filtering block (F1) whose pass-band corresponds to a band of frequencies to be analysed, a first amplifier (AMP) for adjusting the power level of the signals present in said band of frequencies to be analysed, a first digital/analog converter (CAN) for converting said power-adjusted signals, and a first digital processing processor (DSP) for analysing the resultant digital signals and deducing from this the radiocommunication standard of said analysed signals.

20. Receiving unit according to claim 18, characterised in that the pass-band of said first filtering block (F1) is position and size-adjustable.

21. Receiving unit according to [one of claims 13 to 20] claim 13, characterised in that the narrow band processing means comprise a second digital processor for extracting the radio signals via digital filtering and a digital demodulation of said extracted signals.

22. Receiving unit according to claim 21, characterised in that the first and second digital processors are one and the same digital processor (DSP).

23. Receiving unit according to [one of claims 13 to 20] claim 13, characterised in that the narrow band processing means comprise a second filtering block (F2) whose pass-band is adjusted according to the size and

position of the channel to be selected, a second amplifier (AMP) for adjusting the power level of the radio signals to be demodulated, a second analog/digital converter (CAN) and a second digital processing processor (DSP) for demodulating said resultant digital signals.

24. Receiving unit according to claim 23, characterised in that the first and second filtering blocks (F1, F2), the first and second amplifiers, the first and second analog/digital converters and the first and second digital processing processors are physically respectively one and the same filtering block (F3), one and the same amplifier (AMP), one and the same analog/digital converter (CAN) and one and the same digital processing processor (DSP).

25. Receiving unit according to [one of claims 19 to 24] claim 19, characterised in that it further comprises upstream of the wide band analysis means and narrow band processing means a frequency transposition device (M1) for transposing the radio signals to an intermediate frequency.

26. Receiving unit according to [one of claims 19 to 25] claim 19, characterised in that the narrow band processing means further comprise a frequency transposition device (M2) for transposing into a base band or to an extremely low intermediate frequency the signals to be demodulated into a narrow band.

I, the below named translator, hereby declare that :

My name and post office address are as stated below ;

I am conversant with the English and French languages and am a competent translator thereof. I declare further that to the best of my knowledge and belief the following is a true and correct translation of the claims as modified during the international preliminary examination (Chapter II of the PCT) of the International patent application N° **PCT/FR00/00152** filed on **25/01/2000** in the name of **FRANCE TELECOM (SA) & TELEDIFFUSION DE FRANCE (SA).**

Signed this _____ day of _____ July _____ 2001.

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SIGNAL PROCESSING METHOD FOR A DIGITAL WIDE BAND RADIO RECEIVER AND CORRESPONDING RADIO RECEPTION ARCHITECTURE

BACKGROUND OF THE INVENTION

5   The present invention concerns a signal processing method for a wide band digital radio receiver and a reception architecture for implementing said method. It can be applied in particular in the field of mobile telephone terminals or television receivers.

10   The multiplication of standards, especially in telecommunications and more particularly in cellular telephone applications, has forced manufacturers to design specific products for each type of network. The current trend is thus to find a single product, the adaptation of this product to the network being effected by software.

15   this product to the network being effected by software.

      Thus, the embodiment of a universal digital radio able to support all the demodulation diagrams and the most diverse protocol evolutions via a simple updating of the processing software of a numerical processor (DSP)

20   constitutes the main objective of the software radio. Having regard to the technical improvements in the field of numerical processors and analog/digital converters, the software radio aims at digitalising the signals as close as possible to the antenna and designing a generic material

25   portion.

      One of the brakes for applying this technique is the analog/digital converter. In fact, the best solution would consist of directly digitalising the signals at the output of the antenna. Unfortunately, the current technology of A/D

30   converters does not make it possible to work at high sampling frequencies with sufficient dynamics and sensitivity to directly digitalise the signals at the output

of the antenna. There are A/D converters able to sample at 1 Gigasample per second, but their resolution is limited to 8 bits in the best of cases which is clearly inadequate to recover GSM signals (200 KHz channel width and 90 dB dynamics) in a wide band of frequencies of about several hundreds of megahertz.

At the current moment, the only solution to simulate a software radio and thus process all the radio signals in a wide band of frequencies consists of stacking the narrow band digital receivers. However, this solution is not very satisfactory as it proves to be extremely expensive and does not support evolutions of standards.

OBJECTS AND SUMMARY OF THE INVENTION

Also one aim of the invention is to mitigate the drawbacks of said prior art by proposing a signal processing method and a reception architecture for a software radio able to process all the radio signals irrespective of their channel width and power in a wide range of frequencies.

Another aim of the invention is to propose a signal processing method for a wide band radio receiver for dealing with multiplication and the constant evolution of communication standards.

The object of the invention is to provide a method for processing radio signals from a plurality of radiocommunication standards occupying a wide band of frequencies and is characterised in that it comprises the following steps:

- a wide band analysis step for acquiring information concerning the radio signals contained in said wide band of frequencies and selecting a suitable narrow band processing for demodulating said radio signals, and
- a step for the narrow band processing of said radio

signals contained in said wide band of frequencies so as to demodulate them.

In a first embodiment, the wide band analysis step consists of finding from the channels of the radiocommunication standards the channels containing radio signals. As soon as a channel containing a radio signal is found in the band of frequencies portion corresponding to a standard, a narrow band processing adapted to this standard is selected so as to demodulate said radio signal.

In a second embodiment, the wide band analysis consists of acquiring information for identifying the radiocommunication standard associated with each of the radio signals contained in said wide band of frequencies. For example, this information is the bearer frequency and/or the band width of these radio signals. After determining the communication standard of the radio signals of the band, it is possible to select an appropriate narrow band processing for demodulating these radio signals. The determination of the communication standard of the radio signals in effect makes it possible to discriminate the radio signals of the band of frequencies able to be demodulated directly by a digital processor and the radio signals requiring a narrow band processing by analog filtering.

In the case of radio signals able to be directly demodulated (generally relating to low dynamics radiocommunication standards), the narrow band processing (extraction of the signal and demodulation) of the radio signals is directly carried out by a digital processor, preferably the one which has carried out the wide band analysis, and the signal processing method proposed then functions like a genuine software radio.

For the other signals, according to the invention, a

software radio is functionally simulated by isolating the radio signals to be demodulated by analog filtering and by then demodulating these signals, after an analog/digital conversion, by a digital processor.

5   The invention also concerns a software radio receiving architecture able to process the radio signals of a plurality of radiocommunication standards occupying one or several wide bands of frequencies, characterised in that it comprises:

10 - wide band analysis means for acquiring information on the radio signals contained in said wide band of frequencies and selecting a narrow band processing of said radio signals according to the information acquired by said wide band analysis means, and

15 - narrow band processing means for demodulating said radio signals contained in said wide band of frequencies.

BRIEF DESCRIPTION OF THE DRAWINGS

    Other characteristics and advantages of the invention shall appear more readily from a reading of the following detailed description with reference to the accompanying drawings amongst which:

20

- figure 1 is a detailed flowchart of the steps carried out by the signal processing method of the invention, and

- figures 2, 3 and 4 are functional reception architecture diagrams for a software radio for implementing the signal processing method of the invention.

25

DESCRIPTION OF THE PREFERRED EMBODIMENT

    In the continuation of the description, it shall be admitted that the band of frequencies to be analysed can contain several radio signals, each radio signal being transmitted in one radio channel. Furthermore, a distribution or communication standard includes a set of

30

channels satisfying a particular specification.

So as to demodulate all the radio signals, regardless of their width and power, present in one or several wide bands of frequencies, the invention aims to first of all analyse the band of frequencies so as to determine an adequate narrow band processing so as to demodulate the radio signals contained in this band of frequencies and then apply this narrow band processing.

This analysis may consist of looking in the band of frequencies of each communication standard for channels containing useful radio signals for the applications of a receiver.

A flowchart of the steps of a first embodiment of the method of the invention is shown on figure 1.

According to this embodiment, the wide band analysis step first of all comprises a step 101 for filtering the band to be analysed, and a step 102 for adjusting the power level of the received radio signals. The analog signals of the band of frequencies accordingly adjusted are then converted into digital signals in a step 103. Given the fact of the size of the band of frequencies to be analysed (several tens of megahertz), an analog/digital converter is provided able to work at a relatively high sampling frequency of about 250 megasamples per second for a resolution of 8 bits. The digitalised signals are then processed by a digital processor. The aim allotted to this processor is to find the radio signals contained in the band of filtered frequencies. This finding is carried out per communication standard.

If the digital processor knows the possible communication standards in the selected band of frequencies, it selects in step 105 a first standard, otherwise it looks

in a step 104 for a first communication standard in the band of frequencies, for example with the aid of a Fourier transform (FFT) by comparing the various parameters (carrier frequency, band width, type of access,…) of the spectrum obtained at various templates of known parameters, and selects it in the next step 105. This standard selection step is made by filtering of the corresponding portion of the band of frequencies. Then in a step 106 the processor looks in this band portion for a channel transmitting a radio signal.

If this channel is found, the analysed band of frequencies undergoes a narrow band processing step in order to extract the radio signal of said channel and demodulate it. So as to extract this signal, it is necessary to know if the resolution of the A/D converter used in step 103 is sufficient to allow a digital demodulation of this signal after the signal has been extracted by digital filtering. This extraction by digital filtering following analysis of the band is possible when the communication standard of said radio signal extracted has a maximum peak power lower than a threshold value which depends on the resolution of the A/D converter. For example, this is the case for DECT or IS95 signals. The method of the invention then functions as a genuine software radio. The signal extraction step by means of digital filtering is given the reference 107 on figure 1.

In a case where the resolution of the A/D converter is insufficient to directly extract the radio signal by means of digital filtering, according to the invention, it is possible to reduce the size of the band of frequencies to be processed to the width of the channel carrying the radio signal via the analog filtering of said channel (step 108). The filtered signal is then converted (step 109) into a

digital signal.

After analog or digital filtering, the digital signals obtained are then demodulated by a digital processor in a step 110.

Of course, if no signal is found in the first analysed standard, searches for signals are carried out in the other possible standards of the band of frequencies.

After demodulating a first signal, it is possible to in addition demodulate other signals in the same standard or signals in other standards.

It is to be noted that, when the size of the band of frequencies is more than about 100 MHz, the analysis of the band of frequencies is made per portions of 100 MHz for example so that the sensitivity of the converter is sufficient to allow an effective analysis of the band of frequencies in the digital processor.

In a second embodiment (not shown), the steps 104 to 106 are replaced by a more general search step for looking in the selected band of frequencies for information concerning the communication standard of the radio signals contained in this band. A search is made for example of the carrier frequency and/or band width of said radio signals of the band of frequencies. Then the information collected is compared with the known parameters of the communication standards so as to identify the communication standard of the radio signals of the analysed band of frequencies. Once the communication standard(s) of the radio signals of the band of frequencies has/have been identified, it is then possible to determine the narrow band processing to be applied to the signals so as to demodulate them.

It is also possible to look for other parameters characterising the radio signals of the band of frequencies,

such as their cycle frequency or type of modulation used. These parameters shall then be used with the processor for the actual demodulation of the radio signals.

So as to implement these embodiments of the method of the invention, several possible architectures shown on figures 2 to 4 are proposed.

The radio frequency signals received at the input of the device are given the reference RF. In a first embodiment shown on figure 2, the signals RF are transposed to an intermediate frequency FI using a mixer M1 and a synthesizer S. It is to be noted that the signals RF are previously filtered and amplified (not shown) so as to adapt their power level.

The transposed signals are then filtered by a pass-band type filtering block F1 so as to only allow the band of frequencies to be analysed to pass. The pass-band of this filtering block is advantageously size and position-adjustable to allow an analysis of the overall band portion by portion or standard by standard. In practice, the maximum size of the pass-band of the filter F1 is currently limited to about 100 MHz so as to take account of the characteristics of the A/D converters.

The power level of the radio signals of the filtered band is then adjusted by an automatic gain control amplifier AMP. The signals obtained are digitally converted by an analog/digital converter CAN and then processed by a digital processor DSP. This processor is set to carry out standard and channel searches in the digitalised band of frequencies or look for the parameters of the radio signals contained in said band of frequencies.

If the channel found by the processor during analysis contains low dynamics signals (for example DECT or IS95

signals), the extraction of the signal from the found channel is carried out in the processor DSP by means of digital filtering. The signals of this channel can then be demodulated by this same processor or another processor. To be precise, the digital filtering is implemented when the communication standard(s) of the radio signals contained in the band of frequencies has/have a maximum peak power lower than a threshold value which depends on the resolution of the analog/digital converter CAN.

In the opposite case, extraction of the signal from the channel is carried out by analog filtering using a filtering block F2 series-connected with the filtering block F1. The block F2 is either a programmable filter or a bank of filters.

The signals derived from the filtering block F2 are then transmitted to the input of the amplifier AMP by means of a switch COM. The signals of the selected channel are then amplified by the amplifier AMP and then converted by the converter CAN and demodulated by the processor DSP.

It is to be noted that the processor DSP adjusts the sampling frequency fe of the converter CAN and the automatic gain control of the amplifier AMP for the wide band analysis and, if necessary, modifies them for the narrow band processing. It also controls the synthesizer and the size and position adjustment of the pass-band of the filtering blocks F1 and F2.

In the embodiment shown on figure 2, the demodulation of the signals is carried out at the intermediate frequency FI. So as to carry out a baseband demodulation or at a lower intermediate frequency, it is possible to provide a second mixer M2 between the filtering blocks F1 and F2. This embodiment variant is shown on figure 3.

A more generic architecture is shown on figure 4. In this architecture, the filtering blocks F1 and F2 are combined into one and the same filtering block F3 whose pass-band is size and position-adjustable by the processor DSP.

CLAIMS

1. Method for processing the radio signals of a plurality of radiocommunication standards occupying a wide band of frequencies, characterised in that it comprises the following steps :
- a wide band analysis step for acquiring information concerning the radio signals contained in said wide band of frequencies and selecting a suitable narrow band processing for demodulating said radio signals, and
- a step for the narrow band processing of said radio signals contained in said wide band of frequencies so as to demodulate them.

2. Method according to claim 1, characterised in that the wide band analysis step consists of looking for from the channels of the radiocommunication standards those channels containing radio signals able to be demodulated in said narrow band processing step.

3. Method according to claim 1, characterised in that the wide band analysis step consists of acquiring information for identifying the radiocommunication standard associated with each of said radio signals contained in said wide band of frequencies.

4. Method according to claim 3, characterised in that the wide band analysis step consists of looking for the carrier frequency and/or the band width of the radio signals contained in said wide band of frequencies.

5. Method according to claim 3, characterised in that the wide band analysis step further consists of looking for the cycle frequency and/or type of modulation of the radio signals contained in said wide band of frequencies.

6. Method according to claim 3, characterised in that

the wide band analysis step comprises a step for the
digital/analog conversion of the radio signals of said wide
band of frequencies and a step for the digital processing of
the resultant digital signals so as to obtain said
information concerning the radiocommunication standard of
said radio signals.

7. Method according to claim 1, characterised in that,
for each radio signal contained in said wide band of
frequencies, the narrow band processing step comprises a
step for extracting said radio signal and a step for
demodulating said extracted radio signal.

8. Method according to claim 7, characterised in that
the step for extracting said radio signal is effected by an
analog filtering of the wide band of frequencies when the
radiocommunication standard of said radio signal has a
maximum peak power greater than a threshold value.

9. Method according to claim 7, characterised in that
the radio signal extraction step is effected by a digital
filtering of the analysed radio signals when the
radiocommunication standard of said radio signal has a
maximum peak power lower than a threshold value.

10. Method according to claim 8, characterised in that
said threshold value depends on the resolution of the
digital signals at the end of the step for the
analog/digital conversion of said wide band analysis step.

11. Method according to claim 1, characterised in that
the wide band of frequencies is analysed per portion of
several tens of megahertz.

12. Method according to claim 1, characterised in that
the wide band of frequencies is analysed standard by
standard.

13. Software radio receiving unit able to process the

radio signals of a plurality of radiocommunication standards occupying a wide band of frequencies, characterised in that it comprises :

- wide band analysis means for acquiring information concerning the radio signals contained in said wide band of frequencies and selecting a narrow band processing of said radio signals according to the information acquired by said wide band analysis means, and

- narrow band processing means for demodulating said radio signals contained in said wide band of frequencies.

14. Receiving unit according to claim 13, characterised in that the wide band analysis means carry out a search from the channels of the radiocommunication standards those channels containing radio signals.

15. Receiving unit according to claim 13, characterised in that the wide band analysis means carrying out a search for information are able to identify the radiocommunication standard associated with each of said radio signals contained in said wide band of frequencies.

16. Receiving unit according to claim 15, characterised in that the wide band analysis means look for the carrier frequency and/or the band width of the radio signals contained in said wide band of frequencies.

17. Receiving unit according to claim 15, characterised in that the wide band analysis means in addition look for the cycle frequency and/or the modulation type of the radio signals contained in said wide band of frequencies.

18. Receiving unit according to claim 13, characterised in that the narrow band processing means comprise means for extracting the radio signals contained in said wide band of frequencies and means for demodulating said extracted signals.

19. Receiving unit according to claim 13, characterised in that the wide band analysis means comprise a first filtering block (F1) whose pass-band corresponds to a band of frequencies to be analysed, a first amplifier (AMP) for adjusting the power level of the signals present in said band of frequencies to be analysed, a first digital/analog converter (CAN) for converting said power-adjusted signals, and a first digital processing processor (DSP) for analysing the resultant digital signals and deducing from this the radiocommunication standard of said analysed signals.

20. Receiving unit according to claim 18, characterised in that the pass-band of said first filtering block (F1) is position and size-adjustable.

21. Receiving unit according to claim 13, characterised in that the narrow band processing means comprise a second digital processor for extracting the radio signals via digital filtering and a digital demodulation of said extracted signals.

22. Receiving unit according to claim 21, characterised in that the first and second digital processors are one and the same digital processor (DSP).

23. Receiving unit according to claim 13, characterised in that the narrow band processing means comprise a second filtering block (F2) whose pass-band is adjusted according to the size and position of the channel to be selected, a second amplifier (AMP) for adjusting the power level of the radio signals to be demodulated, a second analog/digital converter (CAN) and a second digital processing processor (DSP) for demodulating said resultant digital signals.

24. Receiving unit according to claim 23, characterised in that the first and second filtering blocks (F1, F2), the first and second amplifiers, the first and second

analog/digital converters and the first and second digital processing processors are physically respectively one and the same filtering block (F3), one and the same amplifier (AMP), one and the same analog/digital converter (CAN) and one and the same digital processing processor (DSP).

25. Receiving unit according to claim 19, characterised in that it further comprises upstream of the wide band analysis means and narrow band processing means a frequency transposition device (M1) for transposing the radio signals to an intermediate frequency.

26. Receiving unit according to claim 19, characterised in that the narrow band processing means further comprise a frequency transposition device (M2) for transposing into a base band or to an extremely low intermediate frequency the signals to be demodulated into a narrow band.

SIGNAL PROCESSING METHOD FOR A DIGITAL WIDE BAND RADIO RECEIVER AND CORRESPONDING RADIO RECEPTION ARCHITECTURE

5   The present invention concerns a signal processing method for a wide band digital radio receiver and a reception architecture for implementing said method. It can be applied in particular in the field of mobile telephone terminals or television receivers.

10   The multiplication of standards, especially in telecommunications and more particularly in cellular telephone applications, has forced manufacturers to design specific products for each type of network. The current trend is thus to find a single product, the adaptation of

15   this product to the network being effected by software.

   Thus, the embodiment of a universal digital radio able to support all the demodulation diagrams and the most diverse protocol evolutions via a simple updating of the processing software of a numerical processor (DSP)

20   constitutes the main objective of the software radio. Having regard to the technical improvements in the field of numerical processors and analog/digital converters, the software radio aims at digitalising the signals as close as possible to the antenna and designing a generic material

25   portion.

   One of the brakes for applying this technique is the analog/digital converter. In fact, the best solution would consist of directly digitalising the signals at the output of the antenna. Unfortunately, the current technology of A/D

30   converters does not make it possible to work at high sampling frequencies with sufficient dynamics and sensitivity to directly digitalise the signals at the output

of the antenna. There are A/D converters able to sample at 1 Gigasample per second, but their resolution is limited to 8 bits in the best of cases which is clearly inadequate to recover GSM signals (200 KHz channel width and 90 dB dynamics) in a wide band of frequencies of about several hundreds of megahertz.

At the current moment, the only solution to simulate a software radio and thus process all the radio signals in a wide band of frequencies consists of stacking the narrow band digital receivers. However, this solution is not very satisfactory as it proves to be extremely expensive and does not support evolutions of standards.

Also one aim of the invention is to mitigate the drawbacks of said prior art by proposing a signal processing method and a reception architecture for a software radio able to process all the radio signals irrespective of their channel width and power in a wide range of frequencies.

Another aim of the invention is to propose a signal processing method for a wide band radio receiver for dealing with multiplication and the constant evolution of communication standards.

The object of the invention is to provide a method for processing radio signals from a plurality of radiocommunication standards occupying a wide band of frequencies and is characterised in that it comprises the following steps :

- a wide band analysis step for acquiring information concerning the radio signals contained in said wide band of frequencies and selecting a suitable narrow band processing for demodulating said radio signals, and

- a step for the narrow band processing of said radio signals contained in said wide band of frequencies so as

to demodulate them.

In a first embodiment, the wide band analysis step consists of finding from the channels of the radiocommunication standards the channels containing radio signals. As soon as a channel containing a radio signal is found in the band of frequencies portion corresponding to a standard, a narrow band processing adapted to this standard is selected so as to demodulate said radio signal.

In a second embodiment, the wide band analysis consists of acquiring information for identifying the radiocommunication standard associated with each of the radio signals contained in said wide band of frequencies. For example, this information is the bearer frequency and/or the band width of these radio signals. After determining the communication standard of the radio signals of the band, it is possible to select an appropriate narrow band processing for demodulating these radio signals. The determination of the communication standard of the radio signals in effect makes it possible to discriminate the radio signals of the band of frequencies able to be demodulated directly by a digital processor and the radio signals requiring a narrow band processing by analog filtering.

In the case of radio signals able to be directly demodulated (generally relating to low dynamics radiocommunication standards), the narrow band processing (extraction of the signal and demodulation) of the radio signals is directly carried out by a digital processor, preferably the one which has carried out the wide band analysis, and the signal processing method proposed then functions like a genuine software radio.

For the other signals, according to the invention, a software radio is functionally simulated by isolating the

radio signals to be demodulated by analog filtering and by then demodulating these signals, after an analog/digital conversion, by a digital processor.

The invention also concerns a software radio receiving architecture able to process the radio signals of a plurality of radiocommunication standards occupying one or several wide bands of frequencies, characterised in that it comprises :

- wide band analysis means for acquiring information on the radio signals contained in said wide band of frequencies and selecting a narrow band processing of said radio signals according to the information acquired by said wide band analysis means, and

- narrow band processing means for demodulating said radio signals contained in said wide band of frequencies.

Other characteristics and advantages of the invention shall appear more readily from a reading of the following detailed description with reference to the accompanying drawings amongst which :

- figure 1 is a detailed flowchart of the steps carried out by the signal processing method of the invention, and

- figures 2, 3 and 4 are functional reception architecture diagrams for a software radio for implementing the signal processing method of the invention.

In the continuation of the description, it shall be admitted that the band of frequencies to be analysed can contain several radio signals, each radio signal being transmitted in one radio channel. Furthermore, a distribution or communication standard includes a set of channels satisfying a particular specification.

So as to demodulate all the radio signals, regardless of their width and power, present in one or several wide

bands of frequencies, the invention aims to first of all analyse the band of frequencies so as to determine an adequate narrow band processing so as to demodulate the radio signals contained in this band of frequencies and then apply this narrow band processing.

This analysis may consist of looking in the band of frequencies of each communication standard for channels containing useful radio signals for the applications of a receiver.

A flowchart of the steps of a first embodiment of the method of the invention is shown on figure 1.

According to this embodiment, the wide band analysis step first of all comprises a step 101 for filtering the band to be analysed, and a step 102 for adjusting the power level of the received radio signals. The analog signals of the band of frequencies accordingly adjusted are then converted into digital signals in a step 103. Given the fact of the size of the band of frequencies to be analysed (several tens of megahertz), an analog/digital converter is provided able to work at a relatively high sampling frequency of about 250 megasamples per second for a resolution of 8 bits. The digitalised signals are then processed by a digital processor. The aim allotted to this processor is to find the radio signals contained in the band of filtered frequencies. This finding is carried out per communication standard.

If the digital processor knows the possible communication standards in the selected band of frequencies, it selects in step 105 a first standard, otherwise it looks in a step 104 for a first communication standard in the band of frequencies, for example with the aid of a Fourier transform (FFT) by comparing the various parameters (carrier

frequency, band width, type of access,…) of the spectrum obtained at various templates of known parameters, and selects it in the next step 105. This standard selection step is made by filtering of the corresponding portion of
5   the band of frequencies. Then in a step 106 the processor looks in this band portion for a channel transmitting a radio signal.

If this channel is found, the analysed band of frequencies undergoes a narrow band processing step in order
10 to extract the radio signal of said channel and demodulate it. So as to extract this signal, it is necessary to know if the resolution of the A/D converter used in step 103 is sufficient to allow a digital demodulation of this signal after the signal has been extracted by digital filtering.
15 This extraction by digital filtering following analysis of the band is possible when the communication standard of said radio signal extracted has a maximum peak power lower than a threshold value which depends on the resolution of the A/D converter. For example, this is the case for DECT or IS95
20 signals. The method of the invention then functions as a genuine software radio. The signal extraction step by means of digital filtering is given the reference 107 on figure 1.

In a case where the resolution of the A/D converter is insufficient to directly extract the radio signal by means
25 of digital filtering, according to the invention, it is possible to reduce the size of the band of frequencies to be processed to the width of the channel carrying the radio signal via the analog filtering of said channel (step 108). The filtered signal is then converted (step 109) into a
30 digital signal.

After analog or digital filtering, the digital signals obtained are then demodulated by a digital processor in a

step 110.

Of course, if no signal is found in the first analysed standard, searches for signals are carried out in the other possible standards of the band of frequencies.

After demodulating a first signal, it is possible to in addition demodulate other signals in the same standard or signals in other standards.

It is to be noted that, when the size of the band of frequencies is more than about 100 MHz, the analysis of the band of frequencies is made per portions of 100 MHz for example so that the sensitivity of the converter is sufficient to allow an effective analysis of the band of frequencies in the digital processor.

In a second embodiment (not shown), the steps 104 to 106 are replaced by a more general search step for looking in the selected band of frequencies for information concerning the communication standard of the radio signals contained in this band. A search is made for example of the carrier frequency and/or band width of said radio signals of the band of frequencies. Then the information collected is compared with the known parameters of the communication standards so as to identify the communication standard of the radio signals of the analysed band of frequencies. Once the communication standard(s) of the radio signals of the band of frequencies has/have been identified, it is then possible to determine the narrow band processing to be applied to the signals so as to demodulate them.

It is also possible to look for other parameters characterising the radio signals of the band of frequencies, such as their cycle frequency or type of modulation used. These parameters shall then be used with the processor for the actual demodulation of the radio signals.

So as to implement these embodiments of the method of the invention, several possible architectures shown on figures 2 to 4 are proposed.

The radiofrequency signals received at the input of the device are given the reference RF. In a first embodiment shown on figure 2, the signals RF are transposed to an intermediate frequency FI using a mixer M1 and a synthesizer S. It is to be noted that the signals RF are previously filtered and amplified (not shown) so as to adapt their power level.

The transposed signals are then filtered by a pass-band type filtering block F1 so as to only allow the band of frequencies to be analysed to pass. The pass-band of this filtering block is advantageously size and position-adjustable to allow an analysis of the overall band portion by portion or standard by standard. In practice, the maximum size of the pass-band of the filter F1 is currently limited to about 100 MHz so as to take account of the characteristics of the A/D converters.

The power level of the radio signals of the filtered band is then adjusted by an automatic gain control amplifier AMP. The signals obtained are digitally converted by an analog/digital converter CAN and then processed by a digital processor DSP. This processor is set to carry out standard and channel searches in the digitalised band of frequencies or look for the parameters of the radio signals contained in said band of frequencies.

If the channel found by the processor during analysis contains low dynamics signals (for example DECT or IS95 signals), the extraction of the signal from the found channel is carried out in the processor DSP by means of digital filtering. The signals of this channel can then be

demodulated by this same processor or another processor. To be precise, the digital filtering is implemented when the communication standard(s) of the radio signals contained in the band of frequencies has/have a maximum peak power lower than a threshold value which depends on the resolution of the analog/digital converter CAN.

In the opposite case, extraction of the signal from the channel is carried out by analog filtering using a filtering block F2 series-connected with the filtering block F1. The block F2 is either a programmable filter or a bank of filters.

The signals derived from the filtering block F2 are then transmitted to the input of the amplifier AMP by means of a switch COM. The signals of the selected channel are then amplified by the amplifier AMP and then converted by the converter CAN and demodulated by the processor DSP.

It is to be noted that the processor DSP adjusts the sampling frequency fe of the converter CAN and the automatic gain control of the amplifier AMP for the wide band analysis and, if necessary, modifies them for the narrow band processing. It also controls the synthesizer and the size and position adjustment of the pass-band of the filtering blocks F1 and F2.

In the embodiment shown on figure 2, the demodulation of the signals is carried out at the intermediate frequency FI. So as to carry out a baseband demodulation or at a lower intermediate frequency, it is possible to provide a second mixer M2 between the filtering blocks F1 and F2. This embodiment variant is shown on figure 3.

A more generic architecture is shown on figure 4. In this architecture, the filtering blocks F1 and F2 are combined into one and the same filtering block F3 whose

pass-band is size and position-adjustable by the processor
DSP.

1

CLAIMS

1. Method for processing the radio signals of a plurality of radiocommunication standards occupying a wide band of frequencies, characterised in that it comprises the following steps :
- a wide band analysis step (101-106) for acquiring information concerning the radio signals contained in said wide band of frequencies and selecting a suitable narrow band processing for demodulating said radio signals, and
- a step for the narrow band processing (107-110) of said radio signals contained in said wide band of frequencies so as to demodulate them.

2. Method according to claim 1, characterised in that the wide band analysis step consists of looking for from the channels of the radiocommunication standards those channels containing radio signals able to be demodulated in said narrow band processing step.

3. Method according to claim 1, characterised in that the wide band analysis step (101-106) consists of acquiring information for identifying the radiocommunication standard associated with each of said radio signals contained in said wide band of frequencies.

4. Method according to claim 3, characterised in that the wide band analysis step consists of looking for the carrier frequency and/or the band width of the radio signals contained in said wide band of frequencies.

5. Method according to claim 3 or 4, characterised in that the wide band analysis step further consists of looking for the cycle frequency and/or type of modulation of the radio signals contained in said wide band of frequencies.

MODIFIED SHEET

6. Method according to one of claims 3 to 5, characterised in that the wide band analysis step comprises a step for the digital/analog conversion (103) of the radio signals of said wide band of frequencies and a step for the digital processing (104-106) of the resultant digital signals so as to obtain said information concerning the radiocommunication standard of said radio signals.

7. Method according to one of claims 1 to 6, characterised in that, for each radio signal contained in said wide band of frequencies, the narrow band processing step comprises a step (107; 108) for extracting said radio signal and a step (110) for demodulating said extracted radio signal.

8. Method according to claim 7, characterised in that the step for extracting said radio signal is effected by an analog filtering (108) of the wide band of frequencies when the radiocommunication standard of said radio signal has a maximum peak power greater than a threshold value.

9. Method according to claim 7 or 8, characterised in that the radio signal extraction step is effected by a digital filtering (107) of the analysed radio signals when the radiocommunication standard of said radio signal has a maximum peak power lower than a threshold value.

10. Method according to claim 8 or 9, characterised in that said threshold value depends on the resolution of the digital signals at the end of the step for the analog/digital conversion (103) of said wide band analysis step.

11. Method according to one of claims 1 to 10, characterised in that the wide band of frequencies is analysed per portion of several tens of megahertz.

12. Method according to one of claims 1 to 10,

characterised in that the wide band of frequencies is analysed standard by standard.

13. Software radio receiving unit able to process the radio signals of a plurality of radiocommunication standards occupying a wide band of frequencies, characterised in that it comprises :
- wide band analysis means for acquiring information concerning the radio signals contained in said wide band of frequencies and selecting a narrow band processing of said radio signals according to the information acquired by said wide band analysis means, and
- narrow band processing means for demodulating said radio signals contained in said wide band of frequencies.

14. Receiving unit according to claim 13, characterised in that the wide band analysis means carry out a search from the channels of the radiocommunication standards those channels containing radio signals.

15. Receiving unit according to claim 13, characterised in that the wide band analysis means carrying out a search for information are able to identify the radiocommunication standard associated with each of said radio signals contained in said wide band of frequencies.

16. Receiving unit according to claim 15, characterised in that the wide band analysis means look for the carrier frequency and/or the band width of the radio signals contained in said wide band of frequencies.

17. Receiving unit according to claim 15 or 16, characterised in that the wide band analysis means in addition look for the cycle frequency and/or the modulation type of the radio signals contained in said wide band of frequencies.

18. Receiving unit according to one of claims 13 to 17,

characterised in that the narrow band processing means comprise means for extracting the radio signals contained in said wide band of frequencies and means for demodulating said extracted signals.

19. Receiving unit according to one of claims 13 to 18, characterised in that the wide band analysis means comprise a first filtering block (F1) whose pass-band corresponds to a band of frequencies to be analysed, a first amplifier (AMP) for adjusting the power level of the signals present in said band of frequencies to be analysed, a first digital/analog converter (CAN) for converting said power-adjusted signals, and a first digital processing processor (DSP) for analysing the resultant digital signals and deducing from this the radiocommunication standard of said analysed signals.

20. Receiving unit according to claim 18, characterised in that the pass-band of said first filtering block (F1) is position and size-adjustable.

21. Receiving unit according to one of claims 13 to 20, characterised in that the narrow band processing means comprise a second digital processor for extracting the radio signals via digital filtering and a digital demodulation of said extracted signals.

22. Receiving unit according to claim 21, characterised in that the first and second digital processors are one and the same digital processor (DSP).

23. Receiving unit according to one of claims 13 to 20, characterised in that the narrow band processing means comprise a second filtering block (F2) whose pass-band is adjusted according to the size and position of the channel to be selected, a second amplifier (AMP) for adjusting the power level of the radio signals to be demodulated, a second

analog/digital converter (CAN) and a second digital processing processor (DSP) for demodulating said resultant digital signals.

24. Receiving unit according to claim 23, characterised in that the first and second filtering blocks (F1, F2), the first and second amplifiers, the first and second analog/digital converters and the first and second digital processing processors are physically respectively one and the same filtering block (F3), one and the same amplifier (AMP), one and the same analog/digital converter (CAN) and one and the same digital processing processor (DSP).

25. Receiving unit according to one of claims 19 to 24, characterised in that it further comprises upstream of the wide band analysis means and narrow band processing means a frequency transposition device (M1) for transposing the radio signals to an intermediate frequency.

26. Receiving unit according to one of claims 19 to 25, characterised in that the narrow band processing means further comprise a frequency transposition device (M2) for transposing into a base band or to an extremely low intermediate frequency the signals to be demodulated into a narrow band.
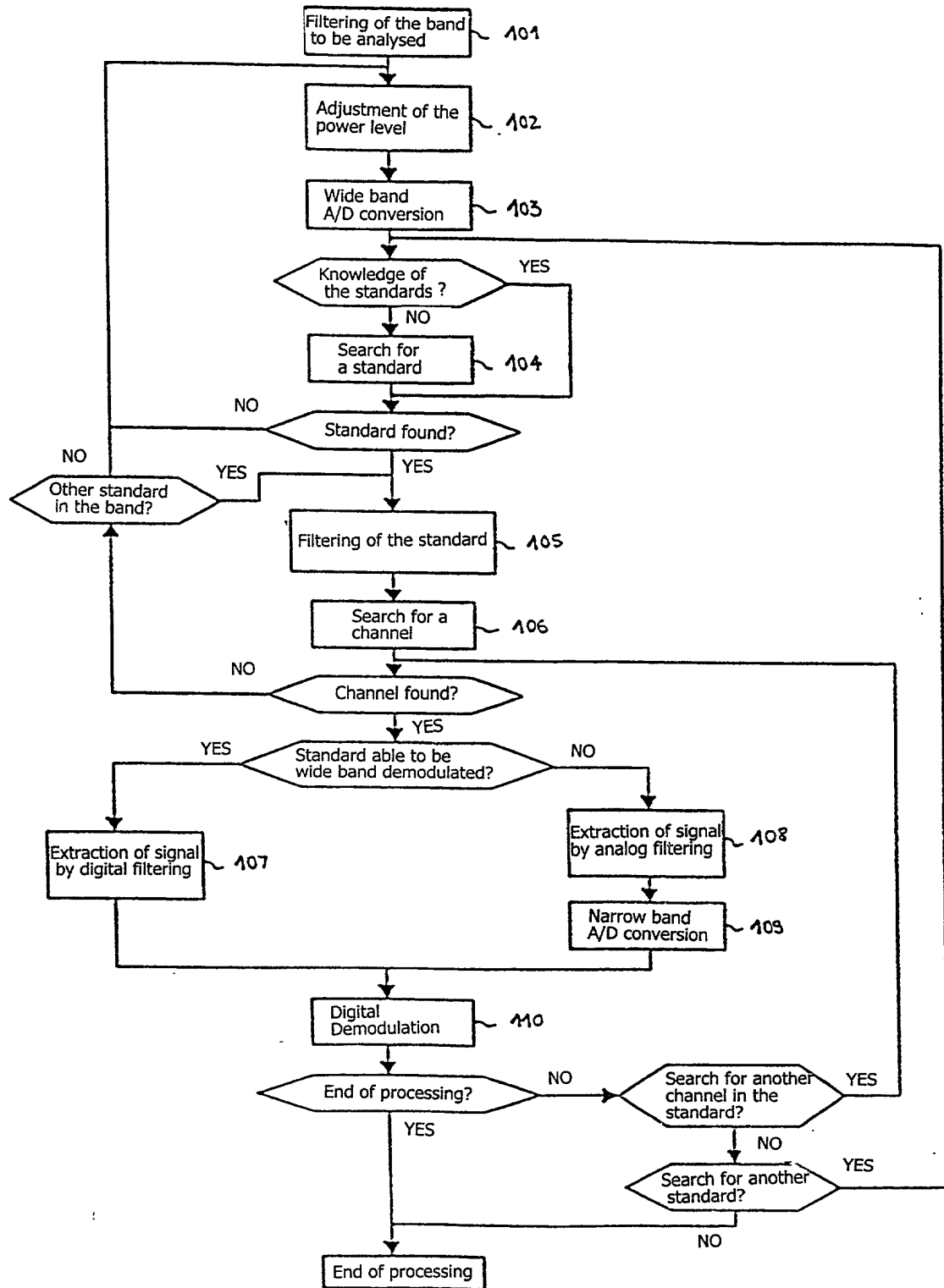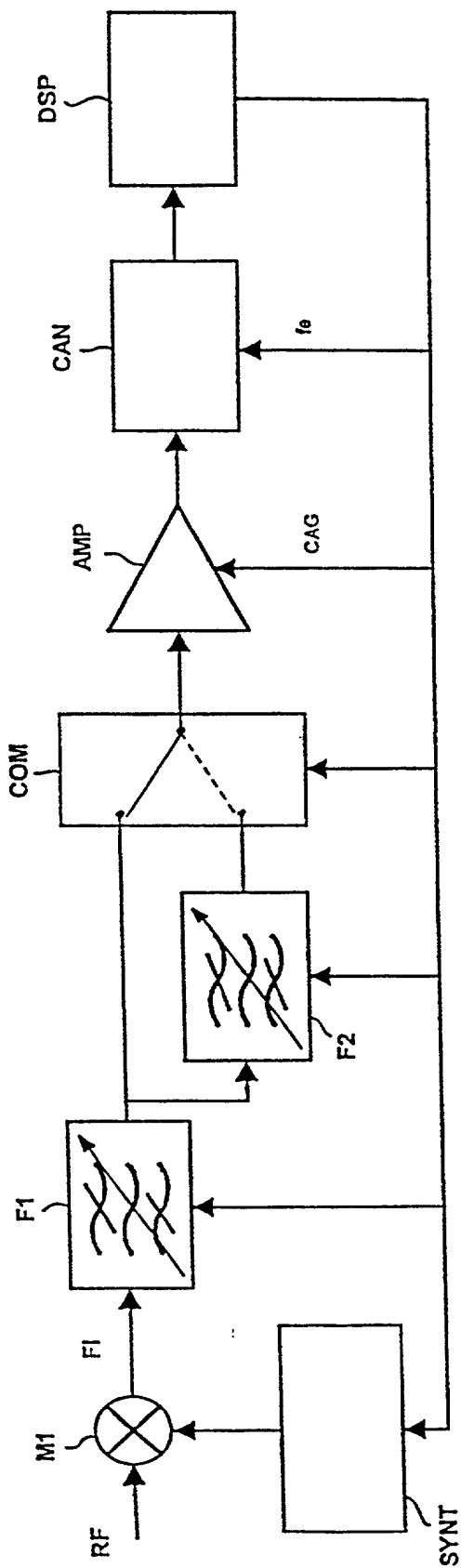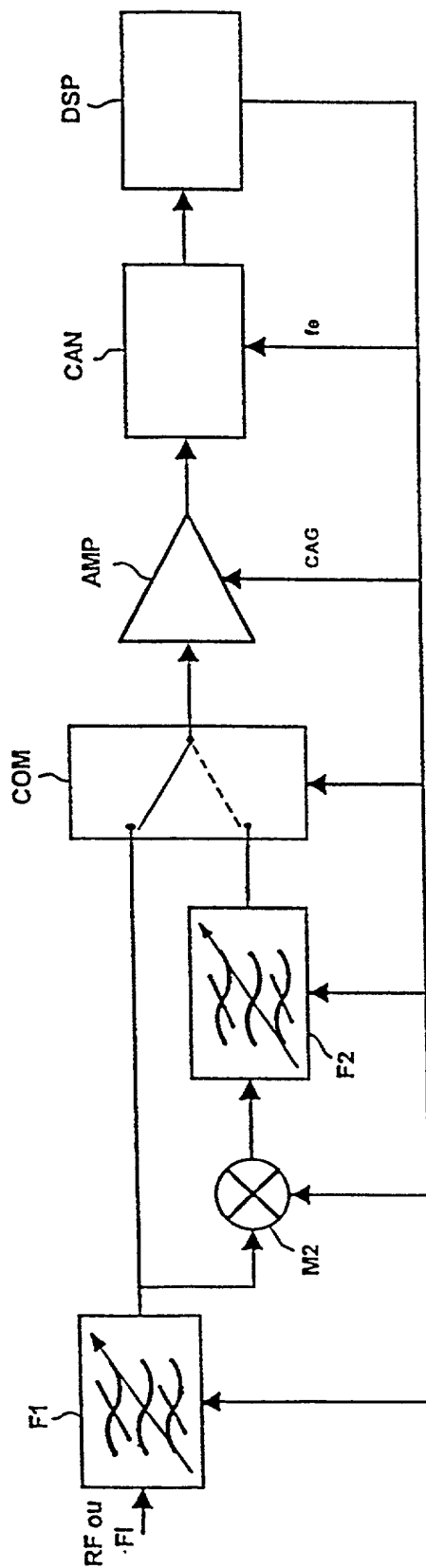
FIGURE 1

FIGURE 2

FIGURE 3

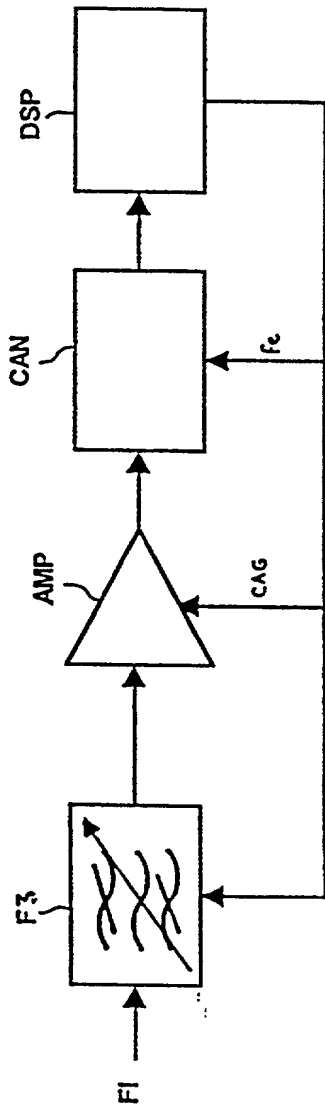FIGURE 4

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION
(37 CFR 1.63)

☐ Declaration Submitted with Initial Filing
   OR
☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16(e)) required)

Attorney Docket Number: ___136.161_____
First Named Inventor: ___Jacques PALICOT_____
COMPLETE IF KNOWN
Application Number: ___09/890 312_____
Filing Date: ___January 25, 2000_____
Group Art Unit: _____
Examiner Name: _____

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

the specification of which
   ☐ is attached hereto
        OR
   ☒ was filed on _January 25, 2000___ as United States Application Number or PCT International Application Number
     __09/890 312_____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)–(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed	Certified Copy Attached?
99 01068	France	January 27, 1999	☐	☐ Yes ☐ No
(Number)	(Country)	(Month/Day/Year Filed)		
			☐	☐ Yes ☐ No
(Number)	(Country)	(Month/Day/Year Filed)		
			☐	☐ Yes ☐ No
(Number)	(Country)	(Month/Day/Year Filed)		

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

(Application Number)	(Month/Day/Year Filed)	☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.
(Application Number)	(Month/Day/Year Filed)	

DECLARATION – Utility or Design Patent Application

Inventor(s): Jacques PALICOT et al.

Title: Signal processing method for a digital wide band radio receiver and corresponding radio reception architecture.

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to the patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Application(s)

PCT/FR00/00152	January 25, 2000	
(Number)	(Month/Day/Year Filed)	(Patent Number (if applicable))

(Number)	(Month/Day/Year Filed)	(Patent Number (if applicable))

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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